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Transformations of nitrogen compounds in granular sludge batch reactors treating municipal wastewater containing bisphenol A (BPA)

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Bisphenol A (BPA) is an endocrine disrupting micro pollutant. It can be biologically removed from wastewater by sorption and biodegradation. In this study, aerobic granular sludge was used, which enables a high concentration of active microorganisms per unit volume of the reactor and a high absorptive capacity due to the high content of extracellular polymers in its structure. The study determined how the concentration of BPA in wastewater influenced the transformations of nitrogen compounds. The study was conducted in five constantly aerated reactors with granules (GSBR) operated at an HRT of 16h. Influent to the control reactor did not contain BPA. BPA concentrations in the wastewater fed to the other four reactors were 2, 4, 6 and 12 mg/L. The overall COD and ammonium concentrations in synthetic wastewater were about 400 mg/L and 50 mg/L, respectively. In all reactors at least 200 cycles were performed. Ammonium nitrogen removal efficiency, resulting from nitrification and biomass synthesis, exceeded 99.5% regardless of the operational conditions. In both the control and the experimental reactors, partial nitrification (oxidation of ammonia nitrogen to nitrites) predominated. The efficiency of nitrification in the control reactor was 88.5±3.7%, and at all tested concentrations; BPA in the influent did not reduce nitrification efficiency. The highest nitrification efficiency (91.4±2.6%) was noted in the reactor fed with wastewater containing 2 mg BPA/L. In the control reactor, the efficiency of nitrogen removal from wastewater by de-nitrification and biomass synthesis was 15.8±8.6%. At concentrations of 2 and 4 mg/L, BPA in wastewater had no effect on nitrogen removal efficiency, but further increasing the concentration of BPA reduced nitrogen removal efficiency by a few percent. In the control reactor, 63% of total nitrogen removal was due to de-nitrification. In the reactor fed with wastewater containing 2 mg BPA/L, de-nitrification made the largest contribution to total nitrogen removal (70.3%).

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